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DETERMINATION OF ACRYLAMIDE IN ROASTED COFFEE POWDERS AND BREWS AT TRACE LEVEL BY SOLID PHASE MICROEXTRACTION WITH POLYMERIC IONIC LIQUID-BASED FIBERS AND GC-MS

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Acrylamide is an unsaturated amide formed when carbohydrate-rich foods are subjected to high temperatures during cooking or thermal processing. The toxicological properties of acrylamide include neurotoxicity, genotoxicity, carcinogenicity, and reproductive toxicity. The roasting of coffee beans, in particular when light roasted, produces acrylamide levels that are among the highest of any food products, although lower levels can be expected due to dilution within coffee beverages [1]. Coffee is a complex matrix given the large number of analytes and the analysis of acrylamide present considerable challenges because of its low molecular weight, high reactivity, lack of chromophore(s) and diagnostic ions. Established ISO methods [2] employ SPE-HPLC-MS-MS in an effort to perform its preconcentration, separation and identification. However, this methodology is time consuming and cannot easily be automated. An alternative to HPLC is GC-MS; however, most GC-MS methods require acrylamide preconcentration and derivatization.

This study describes a simple and rapid sampling and analysis method employing a polymeric ionic liquid (PIL) sorbent coating in direct immersion solid-phase microextraction (SPME) and GC-MS for the analysis of acrylamide at trace-level in coffee brew and powder. A number of crosslinked PIL sorbent coating [3] have been tested showing superior sensitivity in the extraction of acrylamide compared to the commercially available SPME coatings. Ninhydrin was employed as a quenching reagent during extraction to prevent the neo-formation of acrylamide in the GC inlet due to asparagine and glucose co-extraction from the coffee matrix. The PIL fibers produce limit of quantitation for acrylamide in the ppb range achieving results comparable to the ISO method. Given the SPME versatility and capability of automation and the popularity of GC-MS, this method provides a new route for trace-level determination of acrylamide in coffee brew and powder.

References

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- [2] European Standard EN 16618:2015 Food analysis - Determination of acrylamide in food by liquid chromatography tandem mass spectrometry (LC-ESI-MS/MS)
- [3] Ho T.D. et al., Anal. Chim. Acta 843 (2014) 18